

# **NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**

## **TRAFFIC NOISE ABATEMENT POLICY**

*Effective Through July 12, 2011*

The North Carolina Department of Transportation (NCDOT) Traffic Noise Abatement Policy provides for the evaluation of noise barriers or other mitigation measures (e.g., landscaping) for communities and facilities adversely impacted by traffic noise on proposed state and federal highway projects. NCDOT uses this policy to determine the need for noise abatement and the feasibility and reasonableness of abatement measures. Requests for vegetative screening for aesthetic purposes may be considered under the Highway Landscaping Planting Policy.

NCDOT noise abatement policy applies only to "Type I" projects for state, federal or federal-aid highway projects. NCDOT does not participate in "Type II" projects (retrofitting of existing roads, maintenance projects, guardrail projects, rehabilitation projects, existing facilities, and addition of auxiliary lanes). If an auxiliary lane is added between interchanges to improve operational efficiency and it is 1500 feet in length or longer, it should be considered as a Type I project. The addition of ramps at an interchange will also be considered as a Type I project in this policy.

### **Type I Projects**

Sound barriers may be considered for new construction or reconstruction of highways. New construction is building a highway on a new location. Reconstruction involves physically altering an existing highway. The most common examples of reconstruction projects requiring noise analysis are increasing the number of through traffic lanes or substantially changing its vertical grade or horizontal alignment. Consideration of noise abatement as part of construction or reconstruction projects is mandatory in accordance with Code of Federal Regulations, Title 23, Part 772 whenever traffic noise impacts are predicted.

### **PREVENTING NOISE IMPACTS** **Information for the Public and Local Officials**

To prevent future noise impacts on currently undeveloped lands, the following system will be used:

**Public information.** During the development stage of a proposed highway project, area residents and local officials will be kept informed about the project. Meetings (both formal and informal) will be held to provide information as well as to gather comments, opinions and concerns from the public and local officials.

**Public documents.** Environmental documents prepared for the project will contain a list of areas that may be impacted by noise as well as proposals for noise walls and/or other noise abatement measures.

**Corridor/Design Public Hearing.** Proposed noise abatement measures will be presented and discussed at the Design Public Hearing. The noise abatement measures shown on the

design public hearing map will be based on preliminary design and a detailed noise analysis. NCDOT design staff will fine-tune the designs during the right of way plan preparation process. The location of the noise abatement measures should remain essentially the same as shown in the design public hearing map.

**Final determination.** Noise abatement measures deemed reasonable and feasible by NCDOT staff will be shown on the design public hearing map. The opinions of front row property owners will be requested so that a final determination on abatement measures may be made.

**Date of Public Knowledge.** The "Date of Public Knowledge" of the location and potential noise impacts of a proposed highway project will be the approval date of the final environmental document, e.g., Categorical Exclusion (CE), State or Federal Finding of No Significant Impact (FONSI) or State or Federal Record of Decision (ROD).

1. After this date, the federal and state governments are no longer responsible for providing noise abatement measures for new development within the noise impact area of the proposed highway project.
2. The criteria (e.g., trigger date) for determining when undeveloped land is "planned, designed and programmed" for development will be the approval of a building permit for an individual lot or site.
3. It is the responsibility of local governments and private landowners to ensure that noise-compatible designs are used for development permitted after the Date of Public Knowledge.

NCDOT will provide all traffic noise analyses to local government officials within whose jurisdiction a highway project is proposed. Specifically, environmental documents and design noise reports will contain noise tables identifying areas that may be impacted by traffic noise as well as other appropriate design information. Local officials should coordinate distribution of this information to residents, property owners and developers within the affected areas. Following this procedure will encourage planners, building officials, developers and others within affected communities to plan, design and construct noise-compatible development.

## **SOUND AND NOISE**

### **Definitions and Measurements**

Sound is created when an object moves, causing vibrations or waves in air molecules. When vibrations reach our ears we hear sounds. Noise is defined as unwanted or excessive sounds. It is an undesirable by-product of our modern way of life. Sound levels are measured in units called decibels (dB). Adjustment for high and low pitched sounds an average person can hear is called "A-weighted levels" or dBA. Highway traffic noise is assessed using dBA measurements. Noise is further described by its average level over time. In noise abatement studies an "hourly equivalent sound level," or Leq(h), is the constant, average sound level that contains the same amount of sound energy over the time period as does the varying levels of actual traffic noise.

## **NOISE IMPACT DETERMINATION AND ABATEMENT**

Future traffic noise levels are determined by traffic volumes projected for the roadway for the “design year” which is approximately 20 years after highway construction begins. Traffic noise abatement for NCDOT highway projects must be considered when traffic noise impacts are created by either of the following two conditions:

The predicted design year noise levels approach or exceed those measurements shown for the appropriate activity category as shown in Figure 1. NCDOT defines “approach” to be within 1 dBA of the Leq(h) value for the activity categories.

Figure 1. Noise Abatement Criteria Hourly A- Weighted Sound Level in Decibels (dBA)		
Activity Category	Leq(h)	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	67 (Exterior)	Residences, churches, school, libraries, hospitals, motels, hotels, parks, picnic and recreation areas, active sports areas and playgrounds
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A or B
D	Not Applicable	Applicable Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums

OR

The predicted design year noise levels substantially exceed existing noise levels as defined below:

<u>Existing Leq(h)</u>	<u>Increase</u>
50 or less dBA	15 or more dBA
51 dBA	14 or more dBA
52 dBA	13 or more dBA
53 dBA	12 or more dBA
54 dBA	11 or more dBA
55 or more dBA	10 or more dBA

NCDOT uses a 10 dBA to 15 dBA increase of future predicted noise levels above existing noise levels to define “substantial increase” in exterior noise levels. This sliding scale allows a greater increase at a lower existing noise level before a “substantial” increase is defined. As noise walls generally reduce volumes by 5 dBA their use is usually not as effective in less noisy areas. A 10 dBA change in noise levels is judged by most people as a doubling or halving of the loudness of the sounds.

## **NOISE MITIGATION MEASURES**

### **Feasible and Reasonable**

After it has been determined to consider noise abatement as outlined above, several factors must be examined to determine if construction of sound barriers is feasible and reasonable. These factors include benefits to those impacted by noise, the cost of abatement, and overall social, economical and environmental effects of sound barrier construction. Also, Title 23 CFR, Section 772.11(a) states, "In determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit."

**Feasibility:** Feasibility deals primarily with design and engineering considerations. The following issues should be considered in order to determine feasibility:

1. The topography of the location should be considered when determining if a noise wall can be built.
2. A readily noticeable noise reduction “insertion loss” should be achieved by the placement of the noise abatement measure, a minimum of 5 dBA for front row receptors.
3. Site-specific access, drainage, safety and maintenance requirements should be considered when determining noise reduction levels.
4. Other noise sources in the areas should be considered.
5. Noise abatement on non-controlled or partial access control highways usually is not feasible. However, in areas where property owners have agreed to voluntarily relinquish access rights to the highway, noise abatement may be considered.

**Reasonableness:** Reasonableness is a more subjective measure. This consideration should show that good judgement and common sense were used in making a decision. A finding of reasonableness will include the following:

1. **Noise barrier cost** - The abatement measure will be constructed at a reasonable allowable cost per benefited receptor (cost effective). This cost per benefited receptor will be less than or equal to the value (V) determined by dividing the number (N) of benefited receptors into the total cost (C) of the barrier system. A benefited receptor is one that experiences a 5 dBA or more reduction in noise

levels by the construction of the noise wall. The cost of the barrier system will be based on \$15.00 per square foot for the noise mitigation measure plus any other major items necessary for the construction of the measure. These other items could include cost for structure improvements, additional earthwork, additional right-of-way, etc. The reasonable cost effective amount for an impacted area will be \$35,000 per benefited receptor plus an incremental increase of \$500 per dBA average increase (I) in the predicted exterior noise levels of the impacted receptors of the area.

$V = C/N$  which must be equal to or less than  $\$35,000 + \$500(I)$ .

I = Increase in predicted exterior noise levels

Examples:

Cost of noise mitigation measure = \$350,000

Number of benefited receptors = 12

$V = \$350,000/12 = \$29,166$

Projected noise level (72 dBA) – Existing noise level (69 dBA)=I=3 dBA

Cost effective amount =  $\$35,000 + \$500(3) = \$36,500$ , therefore, a noise mitigation measure **would be considered**.

Cost of noise mitigation measure = \$400,000

Number of benefited receptors = 8

$V = \$400,000/8 = \$50,000$

Projected noise level (70 dBA) - Existing noise level (65 dBA)=I=5dBA

Cost effective amount =  $\$35,000 + \$500(5) = \$37,500$ , therefore, a noise mitigation measure **would not be considered**.

2. Noise Wall height and scale – A major consideration of the reasonableness of a noise wall is the visual impact on the adjoining lands. Specifically, a high noise wall alongside low, single-family residences could have a severe adverse visual effect. Considering these factors, the height of the noise wall above the ground should not exceed 25 feet or 7.5 meters. Furthermore, the horizontal distance of the noise wall from residences should be greater than four times the height of the noise wall from the residences.
3. Difference between existing and future noise levels - When real-life noises are heard, most people find it difficult to detect noise level changes of 2-3 dBA. If the differences between the existing and future noise levels are 3 dBA or less, sound mitigation measures are generally considered unreasonable.
4. Opinions of impacted residents - Support for the proposed noise barrier by front row receptors must be documented due to the visual effect of the proposed measures. The Department will solicit the opinions of these receptors and a majority of these receptors must support the construction of the noise abatement measure.
5. Isolated receptors - The cost of abatement measures for isolated receptors versus the noise reduction benefits provided are usually excessive. Therefore, unless

special conditions exist, it generally is not considered reasonable to provide noise abatement for isolated receptors.

6. Commercial areas - Businesses usually prefer visibility and accessibility from the highway rather than noise abatement. Therefore, noise abatement for impacted businesses will not be considered unless requested by the business affected.
7. Residential multi-unit complexes – NCDOT will evaluate residential multi-unit complexes under activity category ‘E’ (interior condition) of the Noise Abatement Criteria (NAC) Table. If activity category ‘B’ (exterior condition) of the NAC Table is also determined in areas of the complex, NCDOT will evaluate both categories ‘B’ and ‘E’ conditions of the multiunit complex. Noise mitigation benefits for qualifying NAC activity category ‘B’ will consider all units of the multi-unit building structure. However, noise mitigation benefits for NAC activity category ‘E’ will consider only first floor units due to noise wall height constraints. Owner occupied units (apartment, townhouse, etc.) will be treated as a separate voting member.
8. Special use areas – Special use areas include, but are not limited to, school, pre-school and daycare facility playgrounds; special exterior areas of churches, hospitals, retirement homes; parks and camps that would be evaluated for NAC activity category ‘B’ (exterior condition). Note: A minimum of 25 students is required to qualify for exterior activity “B” for playgrounds for pre-school and daycare facilities.

To determine cost effectiveness of the noise wall an equivalent number of residents would be determined by using the formula:

Equivalent # Residences = # Occupants/(# people / residence) \* usage

With:

# of occupants = # of students in a school or # of people in a congregation at church, etc.

# of people per residence = 3. (Used in Computer Modeling)

Usage = # of hours used per day/ 24 hours per day

School Example:

Equivalent # of Residents = 500 students/3 \* (4 hrs per day/ 24 hrs per day) = **28**

The factors listed above are not intended to be all encompassing. Rather, these are to illustrate some of the factors that should be considered in determining the feasibility and reasonableness of proposed abatement measures.

### **NOISE WALL CONSTRUCTION, MATERIALS AND AESTHETICS**

The type of materials used in construction of noise barriers and other abatement measures should be an engineering decision based on economics, effectiveness and, to a limited degree, visual impacts. Visual impact considerations will ensure that the proposed noise wall meets a basic aesthetic level as well as a basic durability level so that excessive deterioration or corrosion will not occur.

The steel pile and concrete panel wall is NCDOT's standard noise wall however, NCDOT will consider Context Sensitive Solutions (CSS) as long as other criteria are met.

Consideration should be given to providing earth berms for noise abatement purposes on projects that have earth waste and where sufficient right-of-way exists to construct the berm.

Traditional highway construction resources pay for required noise abatement measures. Should a local government request that materials be used that are more costly than those proposed by NCDOT, the requesting entity must assume 100% of the additional cost.

If a local government insists on the provision of a noise abatement measure deemed not reasonable by NCDOT, a noise wall may be installed provided the local government assumes 100% of the costs. These costs include, but are not limited to, preliminary engineering, construction and maintenance. In addition, local governments must ensure that NCDOT's material, design and construction specifications are met.

### **REVIEW OF POLICY**

This policy shall be reviewed in a manner determined by the Board of Transportation at least every five years.